TECHNOLOGY NEEDS/OPPORTUNITIES STATEMENT

COST-EFFECTIVE, IN SITU REMEDIATION OF URANIUM IN GROUNDWATER

Identification No.: RL-SS47
Date: September 2001

Program: Environmental Restoration
OPS Office/Site: DOE-RL/Hanford
PBS No.: RL-CP01 (RL-ER08)
Operable Unit(s): 200-UP-1
Waste Stream: Disposition Map Designation: ER-10 [technical risk score 5] and ER-18 [technical risk score 5]
TSD Title: N/A
Waste Management Unit: N/A
Facility: N/A

Priority Rating:

This entry addresses the "Accelerated Cleanup: Paths to Closure (ACPC)" priority:

___ 1. Critical to the success of the ACPC
_X_ 2. Provides substantial benefit to ACPC projects (e.g., moderate to high lifecycle cost savings or risk reduction, increased likelihood of compliance, increased assurance to avoid schedule delays)
____ 3. Provides opportunities for significant, but lower cost savings or risk reduction, and may reduce uncertainty in ACPC project success.

Need Title: Cost-effective, In Situ Remediation of Uranium in Groundwater

Need/Opportunity Category: Technology Need

***Need Description*:** In situ remediation of uranium in groundwater by stabilization or by enhancing the mass removal rate of the current pump-and-treat system is needed. In situ processes need to be more efficient than current baseline pump-and-treat operations and provide an endpoint suitable for meeting the remediation objectives.

Schedule Requirements:

Earliest Date Required: 7/1/01

Latest Date Required: 1/1/05

Pump and treat operations are ongoing for groundwater remediation. Operations are scheduled for review of effectiveness and alternate remedial approaches by the regulators in FY05. The

ROD could be amended at this time. It would be beneficial to complete the technology work by this date.

***Problem Description*:** The 200-UP-1 Groundwater Operable Unit is located in the southern half of the 200 West Area. Uranium, a primary contaminant of concern, is present in groundwater, as is technetium-99.

The uranium plume covers an overall area of about 663,620 m^2 (above 20 μg/L). The water table is approximately 255 feet below ground surface at this site. Most of the uranium contamination is located in the upper 15 m or less of the aquifer. The baseline remediation area is 60,575 m^2 in area, or just over 9% of the total plume. The remedial objective of the interim ROD is to reduce contaminant concentrations to 480 μg/L. The maximum concentration of uranium in the groundwater was 2,600 μg/L in fiscal year 1999.

The concentrations of uranium have been slow in responding to the pump-and-treat remediation, especially in comparison to technetium-99, which has achieved the remedial action objective of 9,000 pCi/L in all but a couple of wells. The difference in remediation rates between uranium and technetium-99 is probably due to uranium's propensity to sorb to sediments. Additional information regarding the geochemical groundwater conditions and the sorption processes relevant for uranium in the site sediments is expected over the next two years as scientific studies of these issues are completed.

Benefit to the Project Baseline of Filling Need:

The benefit to the project baseline would be to accelerate remediation of the aquifer, and so meet remediation goals in a reasonable period of time. Lifetime project costs would be reduced. Accelerated remediation would insure that the milestone for completing groundwater remediation by year 2018 would be met.

***Functional Performance Requirements*:** The remedial action objectives per the interim ROD and technology application are to reduce uranium concentrations to 480 μg/L. Although the final ROD has not been issued and thus final remediation action objectives have not been established, the functional requirements can be expected to be the same in either case: removal or stabilization of uranium mass.

Work Breakdown Structure (WBS) No. : 1.4.03.3.1.02.08.16 ***TIP No.:*** N/A

Relevant PBS Milestone: PBS-MC-029

***Justification For Need*:**

Technical: Stabilization or enhanced uranium removal would the accelerate the remediation effort, reduce the overall time for remediation, and provide technical input into the final ROD.

Regulatory: Given the tendency of uranium to sorb to soils, it is questionable if the current P&T cleanup operation is capable of meeting the remediation goal of restoring the aquifer by year 2018.

Environmental Safety & Health: Accelerating the rate of remediation reduces the potential time that workers would be exposed to contamination. It potentially reduces the amount of radioactive waste that would be produced during the life of the project by minimizing remediation time.

Potential Life-Cycle Cost Savings of Need (in $000s) and Cost Savings Explanation: The estimated life-cycle cost savings associated with filling this need is $5M. This estimate is based on an assumed savings of 0.5% of the total Hanford groundwater management life-cycle cost of $1.2B.

Cultural/Stakeholder Concerns:
Cultural/stakeholders are concerned about movement of radioactive contamination off the Hanford Site to the Columbia River, and restoring beneficial use of the land to the public.
Continued spreading or enlargement of the plume in the groundwater beyond the 200 West Area is not acceptable.

Other: Early closeout of this effort releases money for other remediation work, and gains public approval and confidence that progress is being made in restoring Hanford groundwater to beneficial use.

Current Baseline Technology: Uranium contaminated groundwater is pumped from a single extraction well, treated in combination with other groundwater contaminants at the Effluent Treatment Facility (ETF) in 200 West, and then disposed at the State Approved Land Disposal Site (SALDS) north of 200 West. The system removes approximately 20 kg/yr of uranium from the aquifer. The average concentration of uranium in the extracted water was 208 μg/L in FY99.

Cost: The cost to operate the pump & treat is approximately $95K/year. A rough estimate for length of time the current pump & treat system must operate in order to reduce uranium in the groundwater below the action limit is 15 years. Under this scenario, with inflation, the life-cycle cost of the pump and treat system is $6.2M, including compliance and performance monitoring.

Waste: Besides the treated groundwater that is disposed at the SALDS, other wastes generated and associated with the treatment process include power waste (474 drums), process/groundwater contacted (7 drums, 2 boxes), groundwater regulated (4 drums), and sludge (225 drums) have been produced from 3 years of waste going to the ETF.

How Long It Will Take: Remediation with pump and treat may take another 15 years of operation, based on current qualitative rates of remediation (although no official calculations have been reported). After 6 years of operation, the interior plume concentrations are still 10X the MCL in multiple wells and over 130X the MCL of 20 μg/L in the most contaminated well. The rate of remediation will slow as concentrations decrease.

End-User: Richland Environmental Restoration Project

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